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ARMADILLIDIUM TABACARUI (ISOPODA: ONISCIDEA: ARMADILLIDIIDAE), A NEW TROGLOBITIC SPECIES FROM A SULFUROUS CAVE IN ROMANIA

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Abstract.—Four species of terrestrial isopods belonging to *Caucasonethes, Haplophthalmus, Trachelipus* and *Armadillidium* were collected in Movile Cave, Romania. *Trachelipus troglobius* was described recently and *Armadillidium tabacarui,* a new species, is described here. It was collected in the lower level of the cave where it is present in large numbers on the walls of the cave's air-bells. It feeds on the rich chemoautotrophic microbiota covering the walls.

A diverse troglobitic community was recently discovered in Movile Cave in southern Dobrogea, Romania (Sarbu & Popa 1992). Thirty-one previously unknown terrestrial and aquatic species have been identified so far and further discoveries are expected. Most are characterized by an advanced degree of troglomorphy suggesting that they have been isolated from the surface for a long time. Four species of terrestrial isopods (Oniscidea) inhabit Movile Cave: *Trachelipus troglobius* Tabacaru & Boghean, 1989 (Trachelipidae), *Haplophthalmus* sp. and *Caucasonethes* sp. (Trichoniscidae). A new species of *Armadillidium* Latreille, 1804 (Armadillidiidae) is described here.

Armadillidium tabacarui, new species
Fig. 1

Derivation of name.—This new species is named in honor of our colleague, Dr. Ionel Tabacaru, a well-known specialist in terrestrial isopod taxonomy.

Holotype.—Adult male, "Emil Racoviţă" Speleological Institute (ERSI), Bucharest, Romania, from Movile Cave, leg. Viorel Boghean, 28 Dec 1990.

Paratypes.—Three males; two females, ERSI, from Movile Cave, leg. Serban M. Sarbu and Dumitru Pegulescu, 28 Dec 1990.

Distribution.—The lower level of Movile Cave, southern Dobrogea, Romania.

Diagnosis.—The new species of *Armadillidium* is typified by the following characters: volvation of mesospheric type; smooth white tegument; pleotelson triangular with rounded posterior margin; armadillidiid type cephalon; frontal plate projects slightly above vertex and is slightly prismatic; frontal fossa hidden by posterior margin of plate; male ischium of pereiopod VII elongate, thickened distally with slightly concave ventral margin with zone of piliform scales; merus of pereiopod VII strongly widened distally; internal lobe of exopodit of male pleopod 1, pointed and slightly curved laterally; dorsal valvula of stomach, rectangular shaped.

Description.—Body length—6.7 mm in males, 6.45 mm in females; Body width—3.35 mm in males, 3.05 mm in females; Color—white, white-pinkish; Eye—16–18 small ommatidia, with slight traces of pigment (Fig. 1).

Tegument: smooth, lacks granulation, with small hyaline semicircular scales (Fig. 2A). Triangular scale-spines with large base and rounded tip on posterior margin (Fig. 2B) and on surface of pereionites. Triangular scale-spines, with narrow base and pointed tip (Fig. 2C), on anterolateral sur-

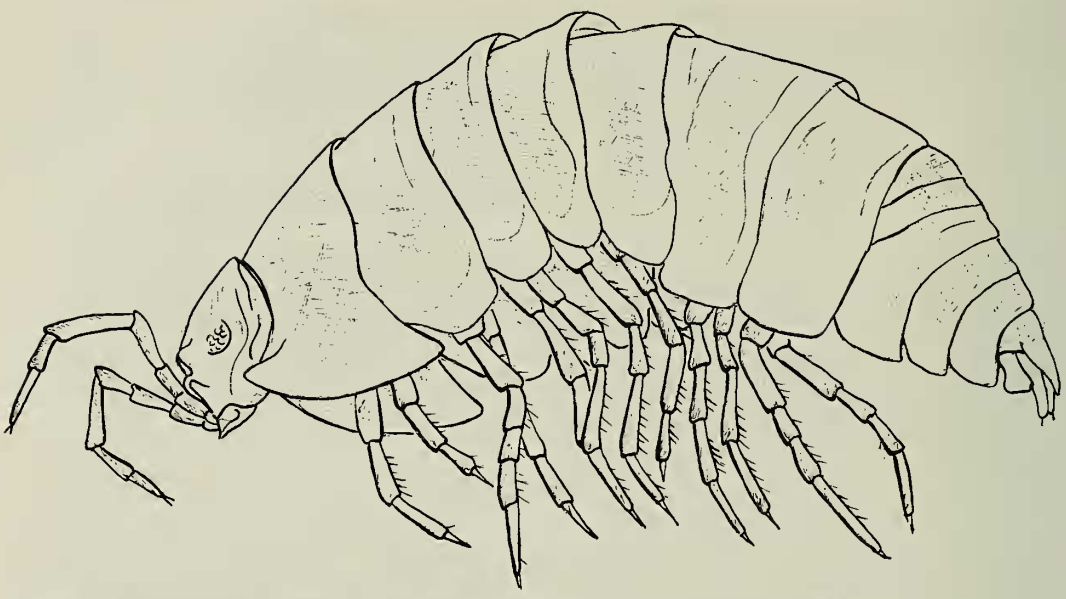

Fig. 1. *Armadillidium tabacarui*, new species: lateral view.

face of pereionites II–VII and especially on uropods. Simple short spines on surfaces of all pereionites (Fig. 2D). Long acutely pointed spines along interior margin of pereionites (Fig. 2E) and on anterolateral surface of pereionites II–VII, along with simple hairs. Long triangulate flexible hyaline scales forming bundles on anterolateral margin of pereionites II–VII (Fig. 2F). Lateral nodes small and inconspicuous (Fig. 2G), located posterolaterally, close to posterior margin; in reference to lateral margin, lateral nodes situated on line extending past posterior angle of pereionites; no major differences regarding position of nodes on all pereionites. Glandular fields of *Armadillidium* type.

Cephalon: rectangular in dorsal view. Scutellum convex, slightly prismatic; anterior margins of scutellum forming wide angle in dorsal view (Fig. 2H), posterior margin straight. Scutellum triangulate in frontal view (Fig. 2I). Subscutellar fossa slightly deepened and widened, hidden by posterior margin of scutellum, bent posteriorly (Fig. 2J). Posterior margin extending very slightly above vertex (Fig. 2K). Postscutellar line continuing toward eyes, bordered by 2 lateral prominent rectangular lobes. Antennal lobes with thick upper margin in frontal view; lobes protrude laterally in dorsal view (Fig. 2L). Frontal line short.

Pereion: anterior angle of pereionite I frontally directed, slightly lifted (mesospheric type). Acute posterior angle, posterior margin only slightly concave (Fig. 1). Pereionites II–VII, of different shapes: pereionites II–IV decrease progressively in length. Epimeron of tergite IV smallest, with rounded edge. Tergite VII with largest epimeron, posterior angle 90° (Fig. 1).

Pleon: size of epimera decreases from pleonites 3 to 5 (Figs. 1, 3A), posterior angle changing from acute (3) to obtusely rounded (5).

Telson: width–length ratio 1.5:1. Telson triangular, rounded tip extending only slightly beyond posterior most part of enveloping pereionite 5. Telson limited ventrally by clearly visible carina (Fig. 3A).

Antennule: articles of unequal length, basal article longest. Short spine present distally on dorsal convex edge of article 1. Ar-

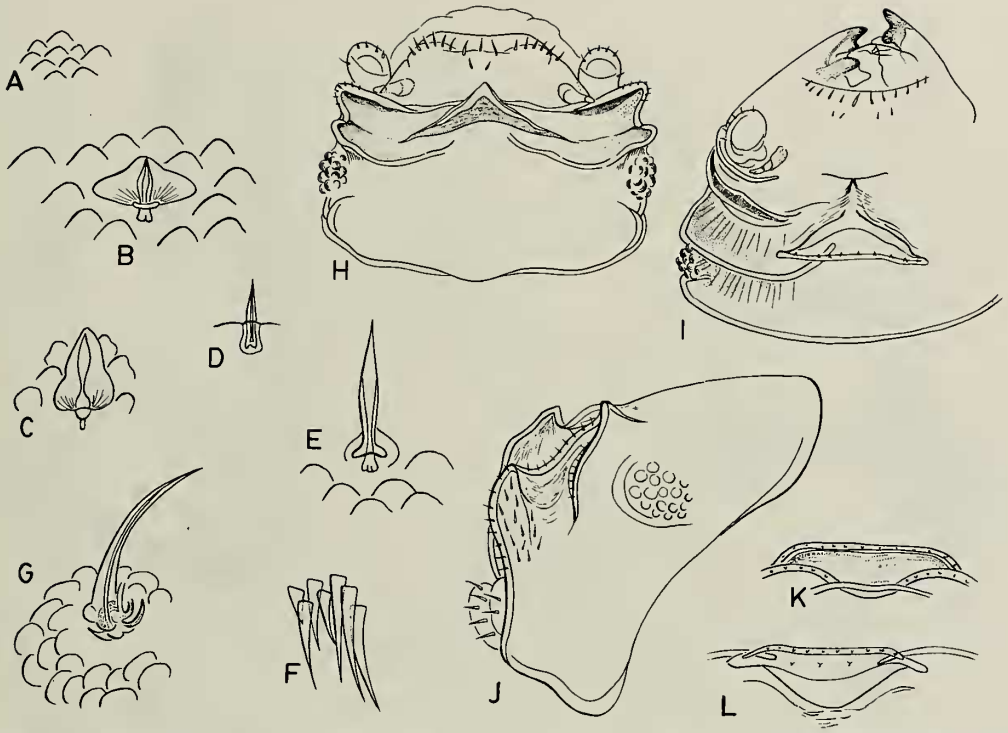

Fig. 2. *Armadillidium tabacarui*, new species: holotype. A, semicircular scales; B, triangulate scale-spines on surface of pereionites; C, triangulate scale-spines on surface of uropods; D, spine on anterolateral surface of pereionites; E, spine on anterolateral surface of pereionites; F, scales on anterolateral margin of pereionites; G, lateral nodes; H, cephalon, dorsal view; I, same, frontal view; J, same, lateral view; K, scutellum, posterior view; L, scutellum, anterior view.

ticle 2 shortest. Apical article bearing 3 rows of aesthetascs (10–12), tip pointed, with 1 aesthetasc (Fig. 3B).

Antenna: long (Fig. 3C), reaching posterior edge of pereionite I. Flagellum with article 2 1.25–1.30× longer than article 1; 5–6 aesthetascs on article 1 (Fig. 3C, b).

Mandible: molar compound; 4 setae in setal row on both mandibles; seta and hair-like setae on lacinia mobilis (Fig. 3D).

Maxillule: outer ramus with 10 apical teeth, outer 4 plain, inner 6 thin with bi- or tri-lobed tip (Fig. 3E). Inner ramus tipped with 2 subequal penicillate setae.

Maxilliped: endite longer than wide, with 3 short spines on upper edge; especially stout spine on endite surface; palp with 2 large spines on basal article; one on edge and complex of spines (one large) on article 2; apex with scale-like spined tip with several spines (Fig. 3F).

Pereiopods: robust (Fig. 4A–C), tegument uniformly covered by semicircular hyaline scales; rod-shaped spines of various sizes and shapes variously placed on pereiopods (Fig. 4B–C, a).

Pereiopod I (Fig. 4A): inner surface with 2 regions covered by long, flexible, hyaline hairs (14–15 rows) on carpus, and short hairs with 4 rows of spines on propodus, both regions bordered on both sides by rows of moderately long setae (Fig. 4A, a). Sternal edge with different shaped rods (Fig. 4A, b–c), forming two rows on carpus and one row of four rods on propodus.

Uropods: length–width ratio of basis 1:2;

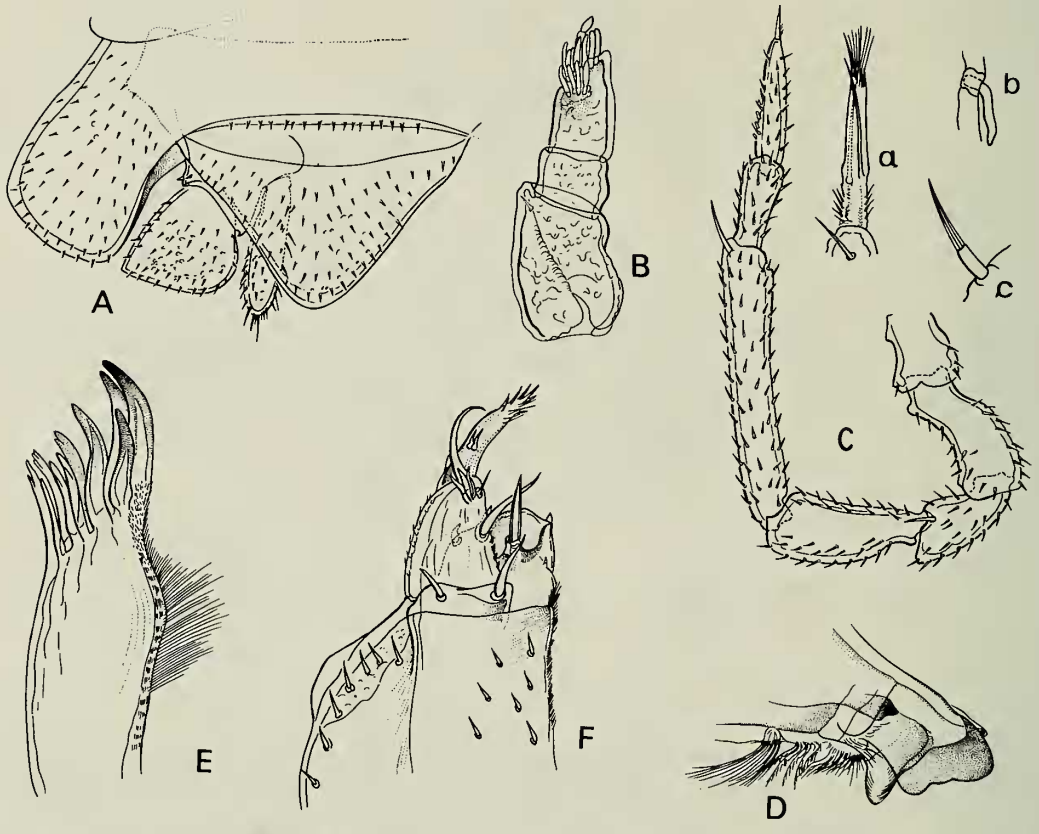

Fig. 3. *Armadillidium tabacarui,* new species: holotype. A, telson; B, antennule; C, antenna: a, apex of antennal flagellum; b, aesthetasc on flagellar article 1; c, terminal spine of peduncular segment 5; D, left mandible; E, outer ramus of maxillule; F, maxilliped.

exit region from basis of flattened wide exopod oblique; exopod with medial margin rounded and lateral corner pointed (Fig. 4D); endopod long and narrow, extending slightly past tip of telson (Fig. 3A).

Stomach (Fig. 4E, F): dorsal lamella of stomach in *A. tabacarui* n.sp. rectangular. Dorsal lamella short and wide, with lateral margins about half as long as posterior and basal margins. Posterior margin sinuous, with central excavation (Fig. 4F). Dorsal lamella covering only ⅓ of stomach length. Lateralium exhibiting complex three dimensional structure: triangulate in dorsal view, and anteriorly covered by dorsal valvula. Upper anterior margin covered by spines. Internal interior surface hyaline and covered by short thin hairs (Fig. 4E, a). Upper plate with well developed tritulating part; anterior zone with abundant hairs (Fig. 4E, b). Trituration zone of lower plate with rows of long curved, laterally oriented hairs (Fig. 4E, c).

Male sexual characters.—Pereiopod VII (Fig. 4B, C): longest; basis very narrow with few tegumentary formations; ischium elongate, wider distally with slightly concave external edge and elongate area covered by long hyaline hairs next to inner surface (Fig. 4C); merus narrow proximally, very wide distally especially toward external edge, being 1.5× longer than wide; last 3 segments with characteristic rods (Fig. 4C, a) on outer edge of both surfaces.

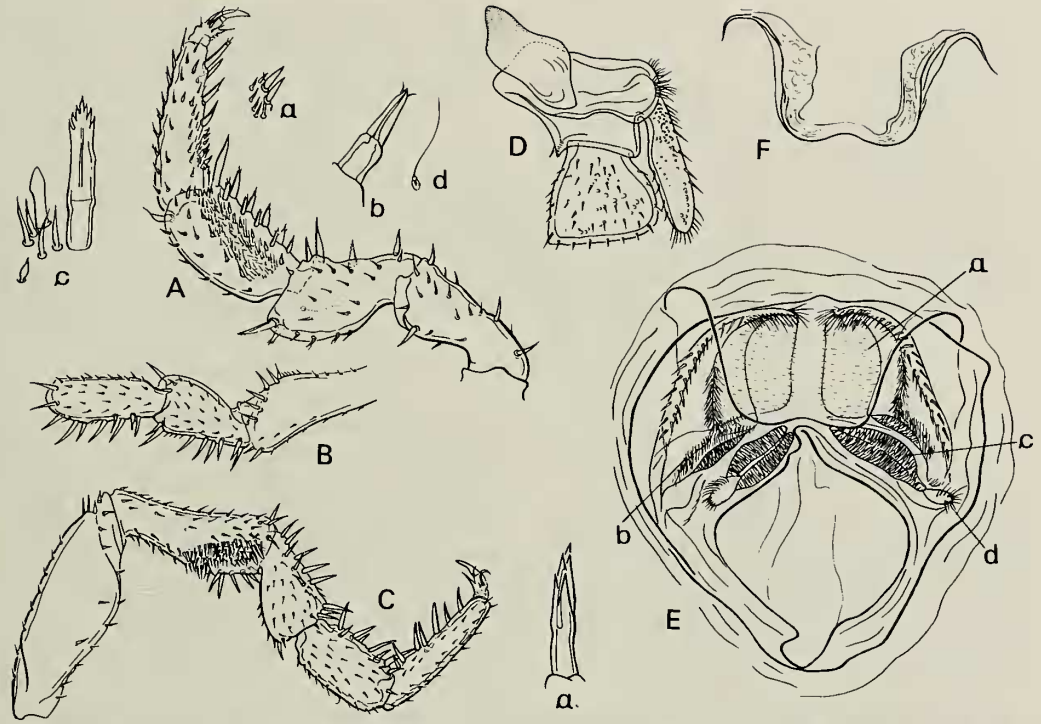

Fig. 4. *Armadillidium tabacarui,* new species: holotype. A, pereiopod I, inner surface: a, short spines on surface of pereiopod I; b, rod on outer surface of pereiopod I; c, rod on rostral surface of pereiopod I; d, sensory hair on pereiopod I; B, pereiopod VII, inner surface; C, same, outer surface: a, rod on sternal edge of pereiopod VII; D, uropod; E, stomach: a, lateralium, interior hyaline surface; b, upper plate; c, trituration zone of lower plate; d, filtration zone of lower plate; F, same, dorsal valvula.

Pleopod 1 (Fig. 5A): triangular exopodit with convex posterolateral margin, pseudotrachea obvious, tip pointed, fringing setae on medial and posterolateral margins of point; endopodit elongate and straight, distal extremity slightly curved with 2 unequally long, curved tips: internal tip longer, with row of foliaceous spines increasing in size distally, extending for short distance along endopod; external tip tiny, curved laterally and plain (Fig. 5B).

Pleopod 2–5 (Fig. 5C–F): exopodits pointed with rows of short hairs; endopodit 2 (Fig. 5C) only slightly longer than exopod.

Discussion

Eight species of *Armadillidium* have been recorded from Romania. Three are found in Dobrogea: *A. jaqueti* Dollfus, 1897 (banks of the Danube at Isaccea, in western Dobrogea), *A. traiani* Demianowics, 1932 (abundant in Bessarabia, also in Dobrogea—Radu 1985), and *A. vulgare* (Latreille) 1804, cosmopolitan (Radu 1985).

Armadillidium tabacarui can be included in the *vulgare-maculatum* group (Strouhal 1927), but a perfect attribution of this species to any of these groups is difficult to make. Compared to *A. vulgare* and *A. traiani* which belong to the *vulgare* group and are surface species present in Dobrogea, the subterranean *A. tabacarui* differs mainly through: the shape of the head (mesospheric type) and through the presence of a piliferous area on the ischium of the pereiopod VII in males. Resemblance with other species of the *vulgare* group consists mainly in

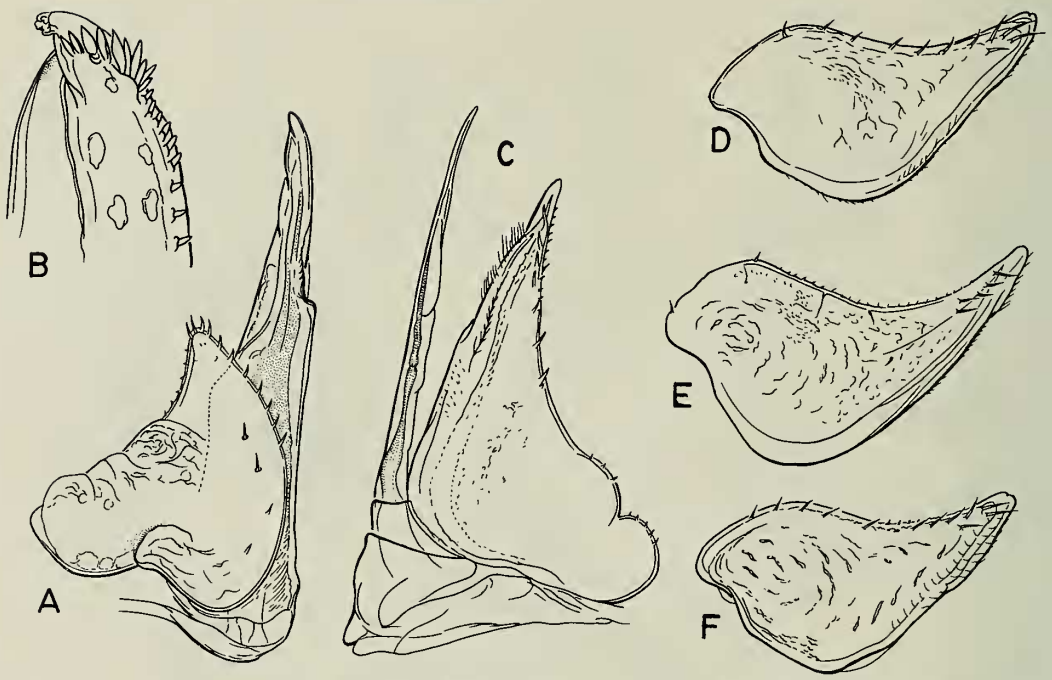

Fig. 5. *Armadillidium tabacarui*, new species: holotype. A, pleopod 1; B, same, distal extremity of endopod; C, pleopod 2; D, exopod of pleopod 3; E, exopod of pleopod 4; F, exopod of pleopod 5.

the shape of the frontal plate of the cephalon which is slightly prominent close to the level of the vertex (Vandel 1962). The presence of the piliferous area in *A. tabacarui* suggests a close resemblance to *A. delattini* Verhoeff, 1943 which inhabits the Marmarean region. The broad telson of *A. tabacarui* resembles that of *A. traiani* and especially *A. absoloni* Stroughal, 1939 (present in caves in Bosnia and Herzegovina), as well as *A. azerbaidzhanum* Schmalfuss, 1990 from Azerbaijan and the northern Caucasus (Schmolzer 1965, Schmalfuss 1990).

The presence of several characters suggests that *A. tabacarui* may belong to the *maculatum* group. These characters are: the mesospheric type of the shape of the body; the triangulate shape of the telson; the shape of the ischium of the pereiopod VII in males. The later character is present in *A. banaticum* Verhoeff, 1907, an endemic species for western Romania (Radu 1985). The comparison of *A. tabacarui* with species of the *maculatum* group present in the Balkan region such as *A. klugi* Brandt, 1883 and *A. bulgaricum* Frankenberger, 1941, reveals additional affinities with this group such as the shape of the pleopod I in males, as well as differences such the shape of the merus of the pereipod VII in males (Frankenberger 1941). The shape of the frontal plate is the main character that determines the imperfect fit of *A. tabacarui* into the *maculatum* group as described by Vandel (1962).

The anatomical analysis of the stomach in our new species reveals differences in the shape of the dorsal lamella and the laterale alium compared to *A. vulgare*. In the latter the dorsal lamella has a deeper central excavation on the posterior margin and the interior hyaline surface has a rounded median margin as opposed to *A. tabacarui* where this margin is straight.

The comparative analysis of the charac-

ters shows that *A. tabacarui* presents a mixture of characters which makes its precise attribution to a certain group of species difficult.

The additional comparison of *A. tabacarui* with taxa from Greece and Turkey, such as those described by Schmalfuss (1981, 1982, 1985), Strouhal (1937, 1956), and Vandel (1980), shows affinities of our new species with eastern mediterranean forms.

Ecological Observations

In the lower level of the cave, the surfaces of the water and the cave walls are covered by microbial mats consisting of heterotrophic and chemoautotrophic sulfur-oxidizing microbes (Sarbu & Popa 1992). All four oniscids were found exclusively in the vicinity of the sulfurous pools, especially in the air-bells of the lower level of the cave (Tabacaru & Boghean 1989). They feed on the microbial mats that cover the walls. Chemoautotrophically produced food (Sarbu & Popa 1992) is in such abundance that *A. tabacarui* reaches densities of several hundred specimens per square meter in the air-bells. On several occasions *A. tabacarui* was seen being eaten by the clubionid spider *Lascona cristiani* and by the large centipede *Cryptops anomalans.*

The physico-chemical parameters of the cave's atmosphere are highly stable without marked diurnal or annual fluctuation. The air temperature is 20.9°C (±0.3) and the relative humidity 100%. The atmosphere of the air-bells is low in oxygen (7–10%) and rich in carbon dioxide (2.5–3%). It contains up to 1 ppm hydrogen sulfide and 1% methane.

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